

RITRACKS: a software for simulation of stochastic radiation track structure, micro- and nano-dosimetry, radiation chemistry and DNA damage for heavy ions

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The code RITRACKS (Relativistic Ion Tracks) has been developed over the last few years at the NASA Johnson Space Center to simulate the effects of ionizing radiations at the microscopic scale, to understand the effects of space radiation at the biological level. The fundamental part of this code is the stochastic simulation of radiation track structure of heavy ions [1], an important component of space radiations. The code can calculate many relevant quantities such as the radial dose, voxel dose, and may also be used to calculate the dose in spherical and cylindrical targets of various sizes [2]. Recently, we have incorporated DNA structure and damage simulations at the molecular scale in RITRACKS. The direct effect of radiations is simulated by introducing a slight modification of the existing particle transport algorithms, using the Binary-Encounter-Bethe model of ionization cross sections for each molecular orbitals of DNA [3]. The simulation of radiation chemistry is done by a step-by-step diffusion-reaction program based on the Green's functions of the diffusion equation [4]. This approach is also used to simulate the indirect effect of ionizing radiation on DNA. The software can be installed independently on PC and tablets using the Windows operating system and does not require any coding from the user. It includes a Graphic User Interface (GUI) and a 3D OpenGL visualization interface. The calculations are executed simultaneously (in parallel) on multiple CPUs. The main features of the software will be presented.

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